

Space Weather Technical Forecast

Issued on Monday, 03 January 2022 at 13:25 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Slight chance of Moderate solar activity until 4th January.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Very Low over the past 24 hours, with only B-class flares observed. There is currently 2 sunspot regions on the visible disc, with AR2918 rotating round to the far side early in the period. AR2916 (Eho/Beta) is approaching the southwest limb and remains a large mature region, but has been stable. AR2922, started the period as a simple bipolar region but has decayed and is now classified as Axx/Alpha. No Earth-directed CMEs have been observed in the available imagery.

Solar Wind / Geomagnetic Activity: Solar winds, observed by DSCOVR and ACE at L1, have generally been elevated or slightly elevated through the period, between 450 and 550 km/s, however they temporarily became strong between 03/0500 UTC and 03/0700 UTC, with a peak of 621 km/s at 03/0525 UTC. Density was steady, around or slightly above average, ranging 7-16 ppcc. The total magnetic field strength has been weak <7 nT, but a sustained period of weakly negative Bz was observed 03/0300 UTC to 03/0930 UTC. The phi angle has been mainly positive (away from the Sun), but with brief switches into the negative orientation. Geomagnetic activity has been mostly Quiet to Unsettled (Kp 1-3), but an Active (Kp 4) interval was recorded 03/0300-0600 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) remained at background levels. High energy electron flux (greater than 2MeV) has been background or moderate levels. Electron fluence was well below the Active threshold, with 5.45e6 integrated pfu recorded at 03/0000 UTC.

Four-Day Space Weather Forecast Summary

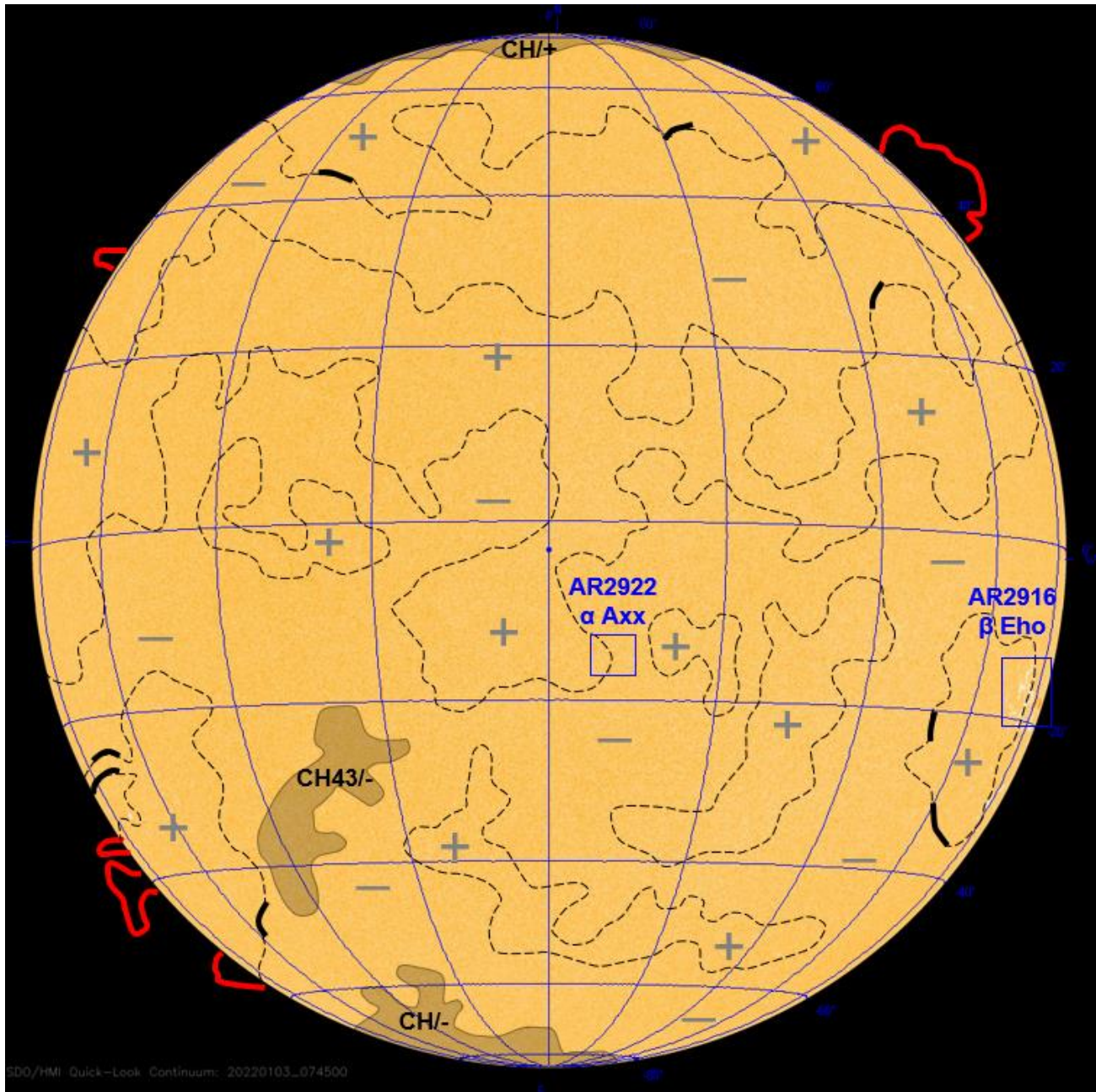
Solar Activity: Very Low or Low solar activity is expected, but with a slight chance of moderate class flares from AR2916 on days 1 and 2 (3rd and 4th).

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are forecast. Elevated solar winds are expected to decline to ambient levels through days 1 and 2 (3rd and 4th) as the effects of coronal hole 40 wane. Quiet to Unsettled geomagnetic activity, with chance of Active intervals is expected on day 1 (3rd). Thereafter, predominantly Quiet activity is expected.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels, with a very slight chance of S1 due to the potential contained within one significant sunspot region. High energy electron flux (greater than 2MeV) is increasingly likely to exceed the High (1e3pfu) level during the period due to effects of the current high speed stream. Electron fluence is also likely to rise through the forecast period, but is not currently expected to exceed to the Active (1e8 integrated pfu) threshold.

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Figure 1. Solar Analysis Valid 03/0800 UTC.



Key: Filament ____, Prominence ____, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - $\beta\gamma$ - $\beta\gamma\delta$ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

No Earth-directed CMEs are forecast through the next four days.

Solar wind speeds are currently elevated under the influence of the high speed stream from coronal hole 40. This coronal hole is now moving from a geoeffective position and solar winds are gradually expected to decline through days 1 and 2 (3rd and 4th), with ambient winds expected on days 3 and 4 (5th and 6th).

Quiet to Unsettled geomagnetic activity is expected on day 1 (3rd), with a chance of Active intervals. Thereafter, geomagnetic activity is expected to be mainly Quiet.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	5	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

NIL

Radio Blackouts - X-Ray Flares:

Very Low or Low solar activity is expected to continue through the forecast period, with a slight chance of increasing to Moderate with isolated M-class flares on days 1 and 2 (3rd and 4th), as AR2916 (Eho/Beta) rotates round the western limb to the far side during the next 24 hours. The only remaining region then is AR2922. This region is a simple uni-polar spot that has been decaying over the past 24 hours and is unlikely to offer any significant X-ray enhancement. However, a bright region is visible towards the southeast limb on STEREO-EUVI. This region is therefore expected to rotate onto the visible disc on days 3 and 4 (5th and 6th) but will require further analysis as it comes into view to determine how it will impact the X-ray flare risk.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	5	2	5
Very Active	R3 to R5 X Class	No	5	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES-16 is currently at background levels and will most likely persist as such, but whilst AR2916 rotates round the western limb there remains a slightly higher than background chance of an S1/S2 event.

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	5	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm ⁻² sr ⁻¹ s ⁻¹)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) is at background to moderate levels, but is expected to rise through the forecast period, with an increasing risk that the diurnal peak will exceed the High (1e3pfu) threshold. The electron fluence is also forecast to follow an increasing trend during this period but is not currently expected to exceed the Active (1e8 integrated pfu) threshold.

GEO Electron Environment	Level (cm ⁻² sr ⁻¹ day ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1x10 ⁸	No	1	20	30	30
Very Active	≥ 2 MeV ≥ 1x10 ⁹	No	1	1	1	1